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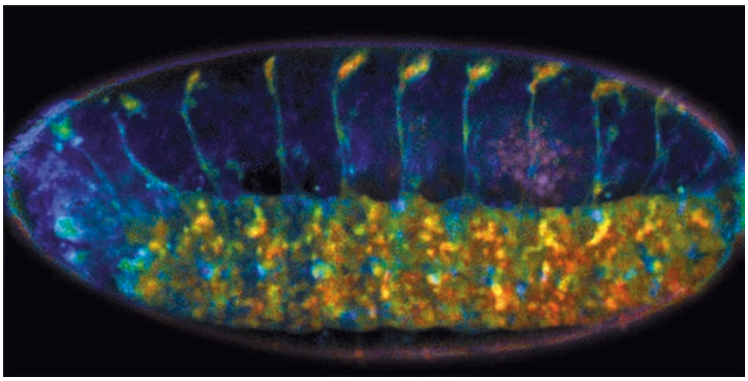
CELL SIGNALLING

Time for work?

Researchers have used an *in vivo* bioprobe imaging technology to study the endogenous activity of the small GTPase CDC42 in *Drosophila melanogaster* embryos. Surprisingly, although CDC42 is ubiquitously expressed, its activity is restricted during development. The study implies that it is the activation pattern of molecules, rather than the expression pattern, that provides important insight into their *in vivo* functions.

> “…although CDC42 is ubiquitously expressed, its activity is restricted during development.”

On activation, CDC42 reversibly binds to a specific peptide called CDC42-binding domain (CBD). The authors took advantage of this and generated an activation bioprobe (A probe) that consists of CDC42 and CBD, and results in a fluorescent signal that is detectable by fluorescent resonance energy transfer only when CDC42 is active. Notably, although CDC42 is ubiquitously expressed, it is inactive for most (~65%) of embryogenesis — until embryonic stage 16 when it is activated in the cells at the dorsal midline, in the trachea and in the central nervous system (CNS). These results explain previous findings showing that, although CDC42 depletion is embryonic lethal, mutant flies do not have developmental defects for most of embryogenesis.



A stage 16 *Drosophila melanogaster* embryo, in which an activation bioprobe is expressed in the central nervous system and is detectable by fluorescent resonance energy transfer only when CDC42 is active (low activation in blue, high activation in orange). Image courtesy of A. Chiba and D. Kamiyama, University of Miami, Coral Gables, USA.

By expressing the A probe in the anterior corner cell (aCC) motorneuron — one of the first neurons in the CNS to develop complex cellular morphologies — the authors found that the activation of CDC42 coincides with the onset of dendritogenesis and is spatially restricted to the cell compartment from which dendrites form. Overexpression of a constitutively active form of CDC42 in the aCC motorneuron causes abnormalities that vary widely and, for example, lead to premature termination of the axonal growth cone. So, the precise spatiotemporal control of CDC42 activity is crucial for neurogenesis.

It will be important to use this bioprobe-assisted approach to study the function of other molecules, the activities of which are continuously regulated in the tissues and cells of an organism.

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ORIGINAL RESEARCH PAPER Kamiyama, D. & Chiba, A. Endogenous activation patterns of Cdc42 GTPase within *Drosophila* embryos. *Science* **324**, 1338–1340 (2009)
FURTHER READING Heasman, S. J. & Ridley, A. J. Mammalian Rho GTPases: new insights into their functions from *in vivo* studies. *Nature Rev. Mol. Cell Biol.* **9**, 690–701 (2008)